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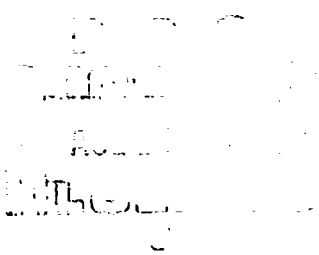
ON-THE-JOB TRAINING COSTS: AN ANALYSIS

BY
SIMON ARZIGIAN



AN ACTIVITY OF THE BUREAU OF NAVAL PERSONNEL

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FOREWORD

This study was accomplished under Objective No. PF016010302.

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SUMMARY AND CONCLUSIONS

Problem

The technical problem is to determine the feasibility of computing the cost of on-the-job training which an enlisted man receives to bring him up to the journeyman level.

Background and Requirements

It was found, during research on personnel costs, that the training cost was one of the key variables in personnel costs of various ratings. Training cost reporting, presently limited to school costs, provides only a partial training cost. There is a need for estimating the cost of training on-the-job for use in a number of management areas.

Approach

In order to estimate on-the-job training costs it was determined that the following four basic questions needed to be answered: (1) what is the journeyman level; (2) what is the rate of learning; (3) how much time is spent by the supervisor; and (4) what are the cost elements involved? Since it was found there were no hard and fast answers to the four basic questions, a number of reasonable assumptions were made for use in the initial development of the system.

Findings, Conclusions, Recommendations

There is a need for on-the-job training costs for use in personnel cost studies and for other management purposes. A review of the literature indicated that there is no system which the Navy can adopt. The system described herein is designed to provide a reasonable estimate of on-the-job training costs. It is recommended that the report be distributed to interested offices for review and comment, particularly as related to the assumptions made herein.

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Introduction

This study, prepared at the request of the Chief of Naval Personnel, presents the results of a preliminary investigation of the feasibility of computing on-the-job training (OJT) costs. Briefly, on-the-job training is that which involves learning or improving job performance under actual working conditions. Usually on-the-job training is conducted in the work situation by the immediate supervisor. At present there is no system within the Navy to "cost out" this type of training. Training cost reporting is limited to formal (school) training.

In the extensive research conducted by this Laboratory in the area of personnel costs, it was found that the training cost was one of the key variables which spelled the difference in personnel costs of various ratings. However, since training cost reporting is limited to school costs the present training cost, for a given rating, may be considered as only a partial cost. Therefore, the addition of an on-the-job training cost to the school cost would provide a more complete training cost. For those ratings which do not have schools, the on-the-job training cost will provide the only training cost and one which is not presently available.

Aside from budgetary purposes, training costs play a major part in many personnel management decisions. For example, the training cost is one of the major elements used to determine eligibility for Proficiency Pay and the Variable Reenlistment Bonus.

Purpose

The purpose of this study is to determine the feasibility of computing the cost of on-the-job training which an enlisted man, in a given rating, receives to bring him up to the "journeyman" level. For this purpose a

journeyman is considered to be a man who has learned his trade (rating) at a specified grade level.

Scope of Study

This study is concerned with the OJT of an enlisted man who reports to a duty station either directly from Recruit Training or from a Class "A" school. The period of time to be considered is that interval from reporting date (to the duty station) until the individual reaches the "Journeyman Level", "Competency Level", or "An Acceptable Level of Technicianship". The three terms, as used here, are considered synonymous, i.e., the individual has reached a point in his development when he is able to perform his duties independently; i.e., with a minimum amount of supervision.

There is, then, a non-productive period or "lead time" (recruit training; class "A" school training, etc.) during which a man is formally (school) trained to a certain level (varies by occupation) in preparation for an operational assignment. An additional period of time on the job will be required before the man reaches the journeyman level. Part of this latter period will also be non-productive or training time, and part will be productive time. That portion to be considered in this study will be the training time.

No attempt will be made to cost out training such as Team, Basic or Group training of any sort. It is recognized that training is a continuous thing in the Navy and does not terminate when the journeyman level is reached, however, this study will only be concerned with the on-the-job training time needed to produce the journeyman. It is not the intent of this study to require any changes, or additions, to the present training cost reporting system. The attempt here is to develop a system for

estimating cost of OJT independent of any reporting system and one which may easily be used. Essentially the development of definitive standard on-the-job standard costs (rates) applicable to each enlisted skill area (rating), is the goal of this research effort.

On-the-Job Training Objectives

In general, the objectives of on-the-job training are:

1. To broaden work experience of personnel
2. To improve work methods and efficiency
3. To provide training in the application of basic skills to specific work assignments

This type of training involves learning or improving job performance under actual working conditions. It may take place under any duty assignment condition, but particularly when assignment to a new billet has taken place or when new equipments or procedures are installed. The organization of this type of training is flexible, follows no set pattern and can readily be adapted to meet changing needs.

Prior Studies

Numerous studies have been conducted by private industry on the subject of labor turnover, its calculation, cost and effects. The consensus is that "break-in" and "breaking-in" costs, which approximate on-the-job training as used in this study, represent the most significant segment of the total labor turnover cost.

The American Management Association* defines "break-in" cost as the expense brought about due to substandard production of new employees while learning their job assignments and becoming adjusted to their work environment.

*Frederick J. Gaudet, Labor Turnover, New York, American Management Association, Inc., 1960, p.58

The "breaking-in" cost is defined as the dollar value of time spent by supervisors and other employees who assist in breaking-in new employees on their job assignments.

A Department of Labor study* discusses "loss of effective production", a cost reflecting the period between the time of decision to quit and the actual time of quitting, and of complete loss during the period of the job vacancy. This, in effect approximates the Navy's "short-timer" problem. Further, the "cost of material spoilage" by new employees including excess of scrap rework caused by inexperienced workers approximates a similar problem in the Navy such as overuse of spare parts, worker caused equipment derangements, excessive supervisory participation in work accomplishment, etc.

A Department of Defense study,**dealing with an evaluation of the proficiency pay program, briefly touched on the problem of how fast first-termers learn on the job. The study found, for example, ". . . . that it takes longer to become a fully effective journeyman field radio repairman than a fully effective journeyman automotive mechanic, and longer to become a fully effective journeyman automotive mechanic than a fully effective journeyman cook". In other words the length of time necessary to become a journeyman can be expected to vary by occupational specialty and be directly related to the degree of skill complexity associated with each speciality. An excerpt from the DOD report is provided as Appendix A.

On-the-job training can be considered an "investment" in that there is a cost involved in this type of training, just as there is in school training.

*U. S. Department of Labor, Suggestions for Control of Turnover and Absenteeism, (BES No. E-61), January 1962, p. 6.

**Gorman C. Smith, "Occupational Pay Differentials for Military Technicians", Office of Deputy Assistant Secretary of Defense, (Special Studies and Requirements), Undated.

In addition, while a man is training on-the-job his productivity is less in varying degrees according to the skill area involved, than it would be if he was fully trained. This concept of investment in human beings has been developed by Becker.*

The following is from a theoretical analysis by Becker:

> "Many workers increase their productivity by learning new skills and perfecting old ones while on the job. For example, the apprentice usually learns a completely new skill while the intern develops skills acquired in medical school, and both are more productive afterward. On-the-job training, therefore, is a process that raises future productivity and differs from school training in that an investment is made on the job rather than in an institution that specializes in teaching. Presumably, future productivity can be improved only at a cost, for otherwise there would be an unlimited demand for training. Included in cost are a value placed on the time and effort of trainees, the 'teaching' provided by others, and the equipment and materials used. These are costs in the sense that they could have been used in producing current output if they were not used in raising future output. The amount spent and the duration of the training period depend partly on the type of training--more is spent for a longer time on an intern than on an operative--partly on production possibilities, and partly on the demand for different skills".

The above concept by Becker is carried forward by Mincer** who offers the following definition of training:

> " . . . the term 'training' denotes investment in acquisition of skill or in improvement of worker productivity. The concept, therefore, includes schooling and training obtained on the job. The latter, under this definition, is a much broader concept than what is conveyed by the common usage of the word 'on-the-job training'. It includes formal and informal training programs in a job situation, as well as what is called 'learning from experience'."

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*Gary S. Becker, "Investment in Human Capital: A Theoretical Analysis," Journal of Political Economy, LXX, No. 5, Part 2 (Supplement: October 1962), pp. 9-49.

**Jacob Mincer, "On-The-Job Training: Costs, Returns, and Some Implications", Journal of Political Economy, LXX, No. 5, Part 2 (Supplement: October 1962), pp. 50-79.

Mincer further points out that " . . . data on costs of training . . . are not only scarce but, in principle, highly unreliable. Such items as loss of production by experienced workers who are helping the trainees or wear and tear of equipment do not show up in any entry as direct costs of training. Rather, they are likely to be hidden in the wage and depreciation costs".

Discussion

There are some basic questions which need to be answered before the cost of on-the-job training can be ascertained. These are:

1. When does a man reach the journeyman level?
2. What is the rate of learning, e.g., what portion of the time involved in reaching the journeyman level should be considered training time and what portion productive time?
3. How much time is spent by the immediate supervisor in the on-the-job training situation?
4. What cost elements should be considered, e.g., individual's pay and allowances, supervisor's pay and allowances, spare parts wastage, etc.?

Each of these questions is examined below.

1. Journeyman Level

What constitutes the journeyman level and when does a man become a journeyman? One approach to this problem is to relate a Navy rating to its civilian counterpart. Then the civilian apprenticeship period could be used as an indication of what the Navy apprenticeship could be. For example, if the civilian apprenticeship for the electronics specialty is 4 years then by analogy the Navy's electronics ratings could be considered to have a

similar apprenticeship period. In other words if it takes 4 years to become a journeyman as a civilian then it will take the same number of years to become a journeyman in the Navy. One, difficulty here is that it is not readily feasible to relate civilian and Navy occupations because:

1. Some Navy occupations do not have readily discernible civilian counterparts, e.g., Sonar Technicians.
2. There is greater specialization in civilian jobs than in Navy jobs.
3. The Navy work situation is different from the civilian work situation in terms of work environment, working hours, etc.

In the establishment of a program for recruiting at advanced pay grades the Navy relates many of its ratings with civilian occupations.* This is done under the Advanced Pay Grade Program which authorizes the direct enlistment or reenlistment in certain reserve units of qualified civilians in rates compatible with their civilian skills. This then is an attempt to determine civilian counterparts for Navy occupations. The concepts employed by this program are of interest to this project and are provided in Appendix B.

The "Table of Navy-Civilian Occupational Relationships"** lists Navy enlisted ratings with the corresponding three-digit occupational grouping codes and titles appearing in Volume II of the Dictionary of Occupational Titles (DOT). The three-digit DOT groupings encompass civilian occupations related to Navy ratings. The information contained in the table is specifically

*U. S. Navy Recruiting Manual, Part D, "Recruiting at Advanced Pay Grades", NAVPERS 15838, Ch. 2, March 1967.

**Manual of Qualifications for Advancement in Rating, NAVPERS 18068B, Ch. 1, May 1966.

intended to assist those completing DD Form 214 (Armed Forces of the United States Report of Transfer or Discharge) and is too general for use in this study.

Another approach would be to try to determine the journeyman level for each Navy rating by a comprehensive study of the various occupational fields in the Navy. This, of course, would be a time-consuming and expensive operation and cannot be justified on the basis of the present study.

As indicated, in the brief discussion of what constitutes the journeyman level, there are so many variables it is difficult to devise a formula which could be universally applied to all the ratings. Since our objective here is to develop a system for estimating the cost of OJT, and since there are time and cost constraints, no attempt will be made to produce a precise measuring instrument. Instead the following deductive approach may be used. For example, pay grades E-1 through E-3 are by definition apprenticeship levels. On the other end of the grade structure pay grades E-6 and above require the performance of supervisory duties--these pay grades could then be considered to be above the journeyman level. This leaves pay grades E-4 and E-5 as possible journeyman levels. A reasonable estimate of completion of the apprenticeship period and the attainment of the journeyman level can be arrived at by using the average length of service for all ratings at the midpoint between E-4 and E-5. Slow advancements in certain ratings, resulting from overstrengths in the career force, (e.g. SD) may cause the journeyman level to fall to E-3.

As an aid to analyzing the wide variety of enlisted skill areas (ratings), four definitive functional categories have been developed. These are titled Technical, Mechanical, Operations, and Support. Definitions of these categories,

together with the ratings classified to each, are shown in Appendix C. The apprenticeship periods which have been assumed for each category, for the purpose of this study, are as follows:

Technician - 36 Months

Mechanic - 30 Months

Operations - 24 Months

Support - 12 Months

NOTE: The above periods are total apprenticeship periods from which all formal school training time is deducted in order to arrive at the on-the-job time factor involved in each category; e.g., Technical Category - Total apprenticeship period - 36 months, less approximately 9 months formal school training, provides a balance of 27 months, which is considered as the on-the-job element of the apprenticeship period for ratings classified to the Technical occupational category. Entry and Recruit Training period is not considered a part of the apprenticeship period.

2. Rate of Learning

Whether an enlisted man reports to his first duty from a Class "A" school or directly from Recruit Training, he must spend some time on-the-job before he reaches the journeyman level. A part of this time will be in a training situation, and the remainder will be in a productive situation. In a 1962 study* Mincer has the following to say on this subject:

> " . . . formal school instruction is neither an exclusive nor a sufficient method of training the labor force. Graduation from some level of schooling does not signify the completion of a training process. It is usually the end of a more general and preparatory stage,

*Jacob Mincer, "On-The-Job Training: Costs, Returns, and Some Implications", Journal of Political Economy, LXX, No. 5, Part 2 (Supplement: October 1962), pp. 50-79.

and the beginning of a more specialized and often prolonged process of acquisition of occupational skill, after entry into the labor force. This second stage, training on the job, ranges from formally organized activities such as apprenticeships and other training programs to the informal processes of learning from experience. Indeed, historically, skills have been acquired mainly by experience on the job".

The Air Force has published a series of reports which has some bearing on this research.* These reports are concerned with evaluations conducted to determine the ability of apprentices, graduated from Air Training Command courses, to perform the duties of their specialty. The general finding of these studies (as related to this research) was that apprentices required varying periods of on-the-job training, depending on Air Force Specialty, to develop 5-skill-level proficiency. The 5-skill-level can be broadly equated to the journeyman level as described herein, i.e., the individual is able to perform the duties of his specialty with a minimum of supervision. Table I has been developed from these Air Force studies. Since the number of graduates studied in these evaluations was small (5-22), and since this data is essentially a by-product of the studies, the data should be used with these points in mind.

A recent Army study examines several Service Schools with respect to their training cost recording practices, the degree of uniformity from school to school, and the cost elements that are used.** The introduction to this study states in part:

"This study is an initial investigation of training costs. It examines only part of the large training area--the part known as advanced individual formal school training at the CONARC Service Schools. Other important training areas are Training Centers, at which both individual formal school training and basic combat training are conducted and on-the-job training conducted in regular Army units".

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*See Bibliography

**George Kollin, "Army Training Costs: Phase I An Examination of Costs and Recording Practices at CONARC Service Schools", Technical Paper RAC-TP-204, May 1966

TABLE I

ON-THE-JOB AND FORMAL TRAINING
TIMES BY AIR FORCE SPECIALTY*

Air Force Specialty	School Training (Weeks)	On-the-Job Training (Months)
Missile Pneudraulic Repairman (Atlas D)	22	6-12
Bomb Navigation Systems Mechanic	40	9-12
Reciprocating Engine Mechanic	15	6-9
Disbursement Accounting Specialist	11	9-12
Weapon Control Systems Mechanic	32	8-15
Mechanical Accessories & Equipment Repairman	17	9-12
Missile Facilities Specialist	24	12
Air Traffic Control Radar Repairman	43	6
Medical Material Specialist	7	6
Fire Protection Specialist	8	6-12

*Source: Air Force studies on performance evaluations in a number of AF Specialties - (See Bibliography)

Phase I of Army study which examined the Service Schools, will be followed by a study of the Training Centers (Phase II) and on-the-job training (Phase III).

The purpose of a study by the U. S. Naval Training Devices Center* was to apply the Training Analysis Procedure (TAP) to the Navy's AAW system in order to identify areas that would benefit from personnel performance improved through training. The study seeks to show the relative effectiveness of existing training solutions in terms of improved system performance. The general TAP methodology calls for a statement of training costs required to achieve the estimated improvement in task performance. In most cases this cost is stated in dollars. In this regard the study states:

> "For training solutions which involve training devices or formal school situations, these cost data are available, and this is a satisfactory dimension along which to compare tasks. In the application of the technique to AAW, OJT on-board ship was a common solution for improvement in many tasks in the system. Serious difficulty was found in developing a comparable cost for this solution".

The Training Devices Center study goes on to say:

> "A number of attempts to derive a rational comparative cost for shipboard OJT were unsuccessful. The essential problem lies in the fact that the ship, while training, is also a member of the operating forces and its time at sea cannot be attributed to training alone. A satisfactory means of pro-rating ship operating costs among operators, or periods of time, or nature of activity, could not be found".

OJT varies from task to task in the amount of time required for such training. Therefore, in lieu of dollar cost information, tasks were compared on the basis of time required to achieve a given level of performance via OJT.

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*Jeantheau, G. G., Andersen, B. G., Yarnold, K. W., "Systems Analysis of AAW Training Requirements", Technical Report: NAVTRADEVCEN 1574-1, November 1965. (AD 625 378)

Since the Training Devices Center study is task - rather than rating - oriented, data on OJT times contained therein are not directly applicable to this study.

Search of the literature did not uncover any data which could be used to determine the productive/non-productive (or training) aspects of Navy jobs. Therefore, for purposes of this study the following approach will be taken. It will be assumed that learning is taking place at a constant rate - with the rate of learning varying according to each of the four categories mentioned earlier. The category representing the most complex skills (technical) would require the largest percentage of training time. A monthly percentage increment for each category would be determined by dividing 100% (the total time involved from completion of recruit training until end of apprenticeship period) by the respective apprenticeship periods. For example, for the technical ratings this would be 100% divided by the 36 months apprenticeship period to give a monthly percentage increment of 2.8%. While the apprenticeship period may include, in some cases, periods of formal school training, only that portion which includes OJT will be costed. This results in the following percentages (rounded to nearest tenth) by category:

Technical - 2.8%

Mechanical - 3.3%

Operations - 4.1%

Support - 8.3%

The above percentages will be applied such that each month the productive/non-productive ratio will be changed, e.g., each month the increase in productive time will be equal to the percentage decrease in non-productive or training time. For an example reflecting use of the above percentages see Table 2.

3. Supervision Time

In the costing of OJT there are a minimum of two individuals involved - the individual being trained and his immediate supervisor. While there may in fact be several layers of supervision involved it is principally the first-line supervisor who is responsible for the training of an apprentice. For purposes of this study it will be assumed that one man is doing the training and that a percentage of his time is devoted to this task.

For lack of definitive data on this aspect it will further be assumed that the supervisor is in the E-6 - E-7 pay grade range, who spends a minimum of 5% of his time "teaching" the apprentice. For this preliminary assessment of procedures for computing OJT costs these assumptions appear to be reasonable ones.

4. Cost Elements

The cost elements to be considered for costing on-the-job training can be varied and large in number. However, with the inclusion of each cost element the problem of costing becomes more complex because of the concurrent increase in the number of input sources, mathematical computations, etc. The cost elements which appear to have the greatest bearing on the cost of OJT are:

a. Trainee's pay and allowances

b. Supervisor's pay and allowances

c. Spare parts wastage

The last cost element, spare parts wastage, can be defined as the excessive use of, or spoilage of, spare parts due to inexperience. While it can be hypothesized that this element will be a significant one, it is not within the scope of this study to attempt to determine its cost implications.

The first two elements, namely, the pay and allowances of trainees and supervisors, can more readily be computed. These then will be the cost elements to be considered in this study.

System Development

A review of the literature has indicated that there is no ready-made system which the Navy can adopt for its use. It is, therefore, necessary to develop a system which the Navy can use for making estimates (albeit gross) of OJT costs. This system can be used to provide an estimate of the amount of resources invested in on-the-job training, as distinguished from investment in formal school training. In addition, the derived estimates can be found useful in studies designed to estimate rates of return on such investments, or their relevance to such programs as Proficiency Pay, Variable Reenlistment Bonus, etc.

As indicated earlier there were four questions which needed to be answered before OJT costs could be determined, or estimated. These in brief were: (1) what is the journeyman level; (2) what is the rate of learning; (3) how much time is spent by the supervisor; and (4) what are the cost elements involved? In the Discussion section, above, each of these questions was explored and it was found that there were no hard and fast answers to these fundamental questions. It was, therefore, found necessary to make some reasonable assumptions in the initial development of the system. These assumptions will be modified or changed as subsequent review and/or use of of the system dictates.

Sample computations are provided below for each of the four categories (see Tables 2, 3, 4 & 5). These computations will be based on the assumptions made earlier regarding the apprenticeship period, rate of learning and supervisor time. Other components will include an average advancement rate for each category and a monthly pay and allowances rate for each pay grade. The supervisor's pay and allowances component is an average of a E-6/E-7. It should be noted that a period of formal school training enters into the computations for each category even though formal schooling is not available to some ratings or represents only a small percentage of the training given in certain other ratings.

TABLE 2

ON-THE-JOB TRAINING COST

CATEGORY I - TECHNICIAN

Month	Pay Grade	Per Cent Training Time (1)	Monthly Pay & Allowances (2)	OJT Cost
1-3	E-1	(Entry, Recruit Training & Leave)	----------	$---------
4-12	E-2/E-3	100% - 77.6% (3)	(36 Weeks "A" School)	---------
13-24	E-3	74.8% - 44%	$245.00	1,746.36
25-39	E-4	41.2% - 0%	458.00	1,415.22
		OJT Cost - Trainee		$3,161.58
		Plus OJT Cost - Supervisor (4)		982.80
		TOTAL OJT COST		$4,144.38

NOTES:

(1) Training Time decreases 2.8% per month during apprenticeship period. The apprenticeship period is 36 months exclusive of a 3 month Entry and Recruit Training period.

(2) Basic pay plus sea pay - based on DOD Monthly Basic Rates. At pay grade E-4 P1 Pro Pay included; assumes E-4 is in career status.

(3) OJT evaluation commences after entry period (100%) and class A school training where applicable (77.6%).

(4) Supervisor's time is 5% of apprenticeship period exclusive of school time. An E6/E7 average of basic pay plus sea pay and P1 Pro Pay, amounting to $728.00 per month, used in computations.

TABLE 3

ON-THE-JOB TRAINING COST

CATEGORY II - MECHANIC

Month	Pay Grade	Per Cent Training Time (1)	Monthly Pay & Allowances (2)	OJT Cost
1-3	E-1	(Entry, Recruit Training & Leave)	----------	$---------
4-7	E-2	100% - 90.1% (3)	(16 Weeks "A" School)	---------
8-11	E-2	86.8% - 76.9%	$189.00	618.78
12-27	E-3	73.6% - 24.1%	245.00	1,890.42
28-33	E-4	20.8% - 0%	408.00	254.59
		OJT Cost - Trainee		$2,763.79
		Plus OJT Cost - Supervisor (4)		881.40
		TOTAL OJT COST		$3,645.19

NOTES:

(1) Training time decreases 3.3% per month during apprenticeship period. The apprenticeship period is 30 months exclusive of a 3 month Entry and Recruit Training period.

(2) Basic pay plus sea pay - based on DOD Monthly Basic Rates.

(3) OJT evaluation commences after entry period (100%) and class A school training where applicable (90.1%).

(4) Supervisor's time is 5% of apprenticeship period exclusive of school time. An E6/E7 average of basic pay plus sea pay, amounting to $678.00 per month, used in computations.

TABLE 4

ON-THE-JOB TRAINING COST

CATEGORY III - OPERATIONS

Month	Pay Grade	Per Cent Training Time (1)	Monthly Pay & Allowances (2)	OJT Cost
1-3	E-1	(Entry, Recruit Training & Leave)	-------- -----	$---------
4-8.5	E-2	100% - 81.6% (3)	(22 Weeks "A" School)	---------
8.6-11	E-2	77.5% - 71.4%	$189.00	351.76
12-27	E-3	67.3% - 0%	245.00	1,319.08
		OJT Cost - Trainee		$1,670.84
		Plus OJT Cost - Supervisor (4)		627.15
		TOTAL OJT COST		$2,297.99

NOTES:

(1) Training time decreases 4.1% per month during apprenticeship period. The apprenticeship period is 24 months exclusive of a 3 month Entry and Recruit Training period.

(2) Basic pay plus sea pay - based on DOD Monthly Basic Rates.

(3) OJT evaluation commences after entry period (100%) and class A school training where applicable (81.6%).

(4) Supervisor's time is 5% of apprenticeship period exclusive of school time. An E6/E7 average of basic pay plus sea pay, amounting to $678.00 per month, used in computations.

TABLE 5

ON-THE-JOB TRAINING COST

CATEGORY IV - SUPPORT

Month	Pay Grade	Per Cent Training Time (1)	Monthly Pay & Allowances (2)	OJT Cost
1-3	E-1	(Entry, Recruit Training & Leave)	----------	$---------
4-5	E-2	100% - 91.7% (3)	(8 Weeks "A" School)	---------
6-11	E-2	83.4% - 41.9%	$189.00	710.45
12-15	E-3	33.6% - 0%	245.00	164.64
		OJT Cost - Trainee		$ 875.09
		Plus OJT Cost - Supervisor (4)		339.00
		TOTAL OJT COST		$1,214.09

NOTES:

(1) Training time decreases 8.3% per month during apprenticeship period. The apprenticeship period is 12 months exclusive of a 3 month Entry and Recruit Training period.

(2) Basic pay plus sea pay - based on DOD Monthly Basic Rates.

(3) OJT evaluation commences after entry period (100%) and class A school training where applicable (91.7%).

(4) Supervisor's time is 5% of apprenticeship period exclusive of school time. An E6/E7 average of basic pay plus sea pay, amounting to $678.00 per month, used in computations.

Conclusions

1. There is a positive need for on-the-job training costs to satisfy a number of management purposes.

2. There does not exist any ready-made system which the Navy can adopt for this purpose.

3. The system described herein is designed to provide a reasonable estimate of on-the-job training costs which can be used for personnel cost studies and for other purposes.

Recommendations

It is recommended that this report be distributed to interested offices for review and comment, particularly as related to the assumptions made in this report.

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APPENDIX A

Relative Effectiveness*

There are several ways to get at this information, [an estimate of how fast first-termers learn on the job] none of them involving any radically new concepts. The periodic administration of performance tests designed to measure the abilities and aptitudes associated with the job in question is one way. A representative group of journeymen who, according to their superiors, are effective in journeymen jobs could be given the tests and these scores used as a base of comparison. Then, the scores of first-termers in various years of service on the same tests could be compared to the scores of the journeymen to get an indication of how fast first-termers learn the job. This approach should be supplemented by supervisor evaluations, information on the length of service of those serving in journeyman jobs, and other standard performance measures.

Clearly, the results of these measurements can be expected to vary considerably among the various military specialties. The rate of learning can be expected to depend on the job performance requirements of the specialty, the amount and kind of training afforded, the abilities of individuals assigned to the specialty, the environment in which the learning takes place, and a host of other considerations. Most of the main ones will differ from one specialty to the next. This is, of course, precisely the point of measuring the rate of learning. Other considerations being equal, the military would prefer to retain an individual in a specialty where the rate of learning

*Extract from: Gorman C. Smith, "Occupational Pay Differentials for Military Technicians", Office of Deputy Assistant Secretary of Defense, (Special Studies and Requirements), undated. pp 131-35.

is low, since it can replace a nonreenlistee in some other specialty with less of a loss in total force effectiveness.

The information on the rate of learning available for this study was quite limited. It consisted of the responses of enlisted supervisors to a questionnaire distributed by the military services for the Defense Study Group on Military Compensation in the last quarter of FY 1962. Responses were tabulated for 22 specialties which by design ranged from the highly technical to some of the least technical. The averages for those responses are listed in Table 5-1. The standard deviation of the individual observations around that average is not available, but was probably quite high because, according to the individual who tabulated the results, the variations were quite large. The data are consistent with a priori expectations. That is, they indicate that it takes longer to become a fully effective journeyman field radio repairman than a fully effective journeyman automotive mechanic, and longer to become a fully effective journeyman automotive mechanic than a fully effective journeyman cook. The Scientific and Engineering Assistant is a special case in which the individual is put to work directly in a skill which he already has when he enters the military.

To apply these data, the service specialties were classified into 22 groups which most nearly corresponded to the skill requirements of the 22 measurements available. The occupational specialty manuals of each service, which spell out the job descriptions of the various specialties, were used as the basis for making these allocations. Care was exercised to retain consistency of grouping across military services in accordance with the Department of Defense Occupational Classification in use at the time unless there was a clear reason,

based on the job descriptions, to make some other classification. This generated a grouping of 22 categories of on the job learning rates. Then, the observed measure obtained by the SGMC survey was applied to each military specialty within the appropriate category.

The effect of this procedure is to use the observed results to discriminate between 22 broad groupings; no discrimination on the basis of this learning curve measure was made within these groups. This treatment makes of the learning curve a very blunt instrument for separation of specialties, an unavoidable result until more detailed estimates of the rate of learning are secured. The treatment does, however, permit discrimination among groups of specialties which can be expected to differ widely in regard to the rate of learning. If the classification system of grouping specialties is reasonably accurate, differences within categories can be expected to be less meaningful than differences among categories.

APPENDIX A (Continued)

TABLE 5-1

AVERAGE PERCENTAGE EFFECTIVENESS OF FIRST-TERMERS RELATIVE TO FULLY QUALIFIED JOURNEYMAN BY YEAR OF SERVICE, SELECTED MILITARY SPECIALTIES

Military Specialty	Percentage Effectiveness of First-Termer Relative to Fully Qualified Journeyman			
	Year of Service			
(1)	1[a] (2)	2 (3)	3 (4)	4 (5)
Linguist	30%	70%	90%	100%
Missile Repairman	31	59	87	100
Nuclear Powerman	32	55	81	100
Field Radio Repairman	34	69	94	100
Cryptanalytic Specialist	45	73	90	100
Aircraft Maintenance Mechanic	49	77	100	100
Intelligence Analyst	50	75	90	100
Track Vehicle Mechanic	51	85	100	100
Cartographic Draftsman	53	88	100	100
Air Defense Fire Control Crew	53	92	100	100
Field Communications Crew	54	88	100	100
Refrigeration Utilities Specialist	55	82	100	100
Personnel Specialist	58	91	100	100

[a]Values in this column apply only to that portion of year of service 1 during which the individual is in the operating forces. No allowance is made here for training time, during which the value will by definition be zero.

APPENDIX A (Continued)

TABLE 5-1

AVERAGE PERCENTAGE EFFECTIVENESS OF FIRST-TERMERS RELATIVE TO FULLY QUALIFIED JOURNEYMAN BY YEAR OF SERVICE, SELECTED MILITARY SPECIALTIES

Military Specialty	Percentage Effectiveness of First-Termer Relative to Fully Qualified Journeyman			
	Year of Service			
(1)	1[a] (2)	2 (3)	3 (4)	4 (5)
Medical Specialist	60%	85%	100%	100%
Carpenter	65	87	100	100
Light Weapons Infantryman	65	90	100	100
Field Artillery Rocket Crew	65	89	100	100
Automotive Mechanic	67	94	100	100
Cook	70	95	100	100
Supply Handler	80	98	100	100
Driver	86	99	100	10[illegible]
Scientific & Engineering Assistant	85	100	100	100

[a]Values in this column apply only to that portion of year of service 1 during which the individual is in the operating forces. No allowance is made here for training time, during which the value will by definition be zero.

APPENDIX B

CONCEPTS ON PAY GRADE ASSIGNMENT*

(1) In civilian life, three levels of skill are recognizable and definable on a somewhat universal basis. They are the learner or apprentice, the artisan or journeymen, and the supervisor or master. At each level there are infinite variations. These three levels are particularly applicable to mechanical trades which make up a large part of Navy ratings.

(2) In general, recruiting programs have been prepared in order that personnel in occupations which require four years of training time and are closely related to a Navy rating or an important segment of a Navy rating will be assigned pay grades as follows:

Learners or apprentices, who have completed two-thirds of their training	E-4
Journeymen or trained workers	E-5
Journeymen with 3 years' experience	E-6
Supervisor or master (who devotes majority of time to supervision) with total of 7 years' journeymen and/or master experience of which at least 3 years must have been in a supervisory capacity	E-7

(3) In determining the pay grade level for occupations that require an apprenticeship or training time of less than four years, the training time involved is compared to a civilian training time-equivalent Navy pay grade

*Extract from: U. S. Navy Recruiting Manual, Part D, "Recruiting at Advanced Pay Grades", NAVPERS 15838, Ch. 2, March 1967, pp. i-ii.

for the journeymen level of the job. Other pay grades are determined by the amount of training or experience above or below the journeymen level as indicated in the following scale:

If civilian job required the training time indicated	Equivalent Navy Pay Grade is
16 months or more but less than 32 months	E-3
32 months or more but less than 48 months	E-4
4 years or more	E-5

Those who have been journeymen 3 years are given one pay grade above that to be given a journeyman of less than 3 years. Those with 7 years' journeyman and/or master experience, 3 years of which have been in a supervisory capacity, are assigned two pay grades above journeyman. The scale is not automatically applied for all civilian jobs, particularly in assigning pay grades E-6 and E-7. For particular jobs, the value of which may be considered limited to the Navy, the upper limit has been set at pay grade E-5, regardless of length of experience or supervisory responsibility.

(4) In assigning pay grades in non-mechanical occupations, the concept of apprentice, journeyman, and master cannot be closely followed; but, in general, the concept is that the higher pay grades will require broader experiences, greater skill, and increased supervisory responsibility. The time-equivalent pay grade scale is useful in setting the experience requirements for non-mechanical occupations. For ratings, the fact that civilian jobs related to Navy ratings vary in scope creates the special problems that are treated separately in each rating program.

(5) In addition to providing the minimum qualification requirements of ratings, the advanced pay grades programs indicate the initial recruitment sources, occupationally and organizationally, from which applicants may be selected. Jobs existing in private industry are identified by title and also by codes taken from the Dictionary of Occupational Titles published by the U. S. Department of Labor; those jobs found in U. S. Civil Service are identified by title and Civil Service job code. It should be carefully noted that the mere listing of jobs does not mean that persons who have filled them are necessarily qualified for the rating involved. Each individual work history must be examined to determine the exact nature of the job background and accurate appraisal must be made as to the rating and pay grade for which an individual may be qualified.

(6) In summary, the standards for selection in the program are prepared in a manner which takes the special problems of each rating into account and allows the Navy to obtain a person well qualified to go to work in a rating at the pay grade assigned. Pay grades are assigned in a manner consistent with recognized levels for advancement in the requirements of the Manual of Qualifications for Advancement in Rating (NavPers 18068B) insofar as the two are reconcilable. A civilian training time-equivalent Navy pay grade scale is used as a guide in setting the pay grade level of jobs.

APPENDIX C

DEFINITIONS OF MAN-MACHINE TRADE-OFF FUNCTIONAL (OCCUPATIONAL) CATEGORIES AND DISTRIBUTION OF NAVY SEA-GOING AND AVIATION RATINGS BY SUCH CATEGORIES*

(Ratings in Rating Code Order Within Categories)

TECHNICIAN RATING - Those enlisted general and service ratings which are, in most cases, electronically oriented and which are characterized by the fact that a predominant proportion of the personnel in such ratings have or will be trained in relatively complex, long term, formal training programs which require well above average classification test score patterns for entry into such training. These ratings also involve a direct responsibility for the maintenance and operational effectiveness of exceptionally complex systems and/or equipments. On an interim basis, the following shipboard or aviation ratings have been classified to this occupational category:

ST	GM	FT	MT	DS	ATN	AQF
STG	GMM	FTG	ET	AV	AX	
STS	GMT	FTM	ETN	AT	AQ	
TM	GMG	FTB	ETR	ATR	AQB	

MECHANIC RATINGS - Those enlisted general and service ratings the basic purpose of which is the maintenance and operation of electrical - mechanical and related systems and/or equipment, including fabrication functions, associated with ship or aircraft maintenance. On an interim basis the following shipboard or aviation ratings have been assigned to this occupational group:

MN	EN	SF	AF	AM	ASE
PI	MR	SFM	AD	AMS	ASH

*Developed by Pers-A316 for interim personnel costing purposes.

JM	BT	SFP	ADR	AMH	ASM
IM	BR	DC	ADJ	AME	
SP	EM	PM	AO	PR	
MM	IC	ML	AE	AS	

OPERATIONS RATINGS - Those enlisted general and service ratings the characteristics of which are primarily oriented toward ship and aviation operations and communication system operation. On an interim basis, the following shipboard or aviation ratings have been classified to this occupational category:

BM	RD	DP(MA)	ABE	AG
QM	RM	AC	ABF	PH
SM	CT	AB	ABH	PT

SUPPORT RATINGS - Those enlisted general and service ratings, the functions of which are to provide administrative, medical, dental, personal or general support to all unit personnel. Skill complexity involved ranges widely consisting of the intricate and very complex skills involved in certain medical/dental specialties to the relatively less complex skills related to certain personnel service functions. On an interim basis, the following shipboard or aviation ratings have been classified to this occupational category:

YN	SK	SH	LI	AK	*DT
CYN	DK	JO	DM	AZ	SD
PN	CS	PC	MU	*HM	

*Tentatively grouped to Support Ratings since finite cost data is not available.

APPENDIX C (Continued)

RATINGS NOT INCLUDED ABOVE

(Shore - Based)

TECHNICIAN	MECHANIC					SUPPORT
TD	CU	CEW	CM	BUH	UT	EA
	CE	EQ	CMA	BUR	UTA	EAD
	CEP	EO	CMH	SW	UTB	EAS
	CES	EOH	BU	SWE	UTF	
	CET	EON	BUL	SWF	UTW	

NOTE: Manpower costs by Functional categories represent an average cost for all enlisted personnel associated with ratings classified to a particular category irrespective of pay grade, e.g. Pay grade E-2 through E-9, and for the entire range of service, e.g. 1 through 30 years. These inclusive aspects demonstrate the grossness of these interim manpower costs and represent, partially, the areas where more definitive information must be developed.

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13. ABSTRACT

~~This~~ study presents the results of a preliminary investigation of the feasibility of computing on-the-job training costs. For purpose of this study on-the-job training is that which involves learning or improving job performance under actual working conditions.

At present there is no system within the Navy to "cost out" on-the-job training. Training cost reporting is limited to formal, or school, training. The addition of an on-the-job training cost to the school cost (which) would provide a more "complete" training cost. Training costs play a major part in many personnel management decisions; therefore a training cost which reflects all the training provided an individual would prove valuable.

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